

Name _____ Period _____

Skill 11.01 Exercise 1

Refer to the figure shown to the right. Identify the range of wavelengths associated with each color. The “Reds” have already been filled in.

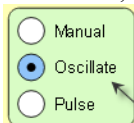
Color Range	Wavelengths
Reds	680–740
Oranges	
Yellows	
Greens	
Blues	
Violets	

Skill 11.01 Exercise 2

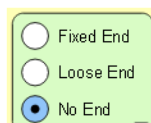
Navigate to the wave on a string simulator.

http://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html

Once there, select the “No end” option and the “Oscillate” option

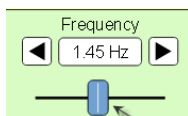


Select the
“Oscillate”
option.



Select the “No
End” option.

Locate the frequency slider. Move it back and forth and observe how the wavelength changes.



Slide this back and forth
and observe how the
wavelength changes.

(a) When you increase the frequency, what happens to the wavelength? Does it increase or decrease?

(b) When you decrease the frequency, what happens to the wavelength? Does it increase or decrease?

(c) What is the relationship between frequency and wavelength? Is it inverse or direct?

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Skill 11.01 Exercise 3

Refer to the colors below. Sort the colors from low to high with respect to frequency.

Color Range	Order of frequency (1 = lowest)
Reds	
Oranges	
Yellows	
Greens	
Blues	
Violets	

Skill 11.01 Problem 4

(a) Are the wavelengths of ultra-violet light longer or shorter than that of visible light?

(b) Are the frequencies of ultra-violet light longer or shorter than that of visible light?

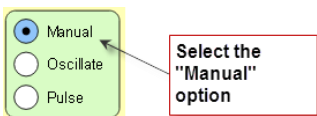
(c) Are the wavelengths of infra-red light longer or shorter than that of visible light?

(d) Are the frequencies of infra-red light longer or shorter than that of visible light?

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Skill 11.02 Problem 1

Now return to the simulator (http://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html) Select the “Manual” option.



Move the wrench up and down as fast as you can and observe the wavelength. Now move the wrench up and down slowly and observe the wavelength.

- When you moved the wrench up and down quickly (high energy), what happened to the wavelength? Did it increase or decrease? What happened to the frequency? Did it increase or decrease?
- When you moved the wrench up and down slowly (low energy), what happened to the wavelength? Did it increase or decrease? What happened to the frequency? Did it increase or decrease?
- What is the relationship between energy and wavelength? Is it inverse or direct?
- What is the relationship between energy and frequency? Is it inverse or direct?

Skill 11.02 Problem 2

Refer to the colors below. Sort the colors from low to high with respect to energy, frequency, and wavelength.

Color Range	Order of energy (1 = lowest)	Order of wavelength (1 = smallest)	Order of frequency (1 = smallest)
Reds			
Oranges			
Yellows			
Greens			
Blues			
Violets			

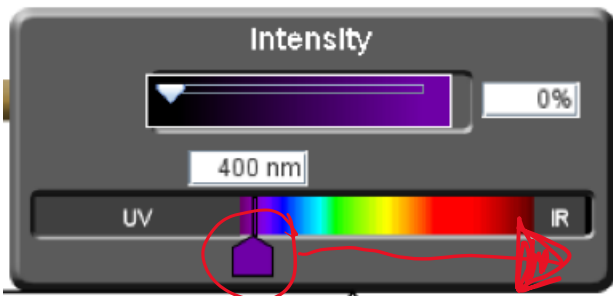
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Skill 11.03 Problem 1

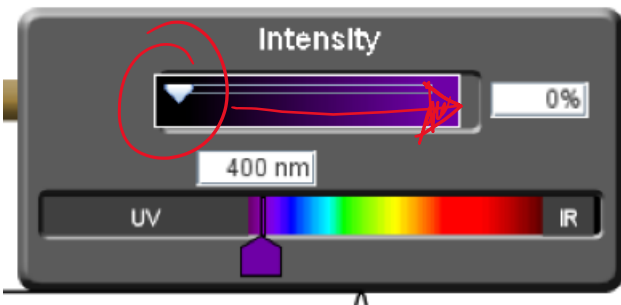
Navigate to the following simulation (be patient, it takes some time to load)

<https://phet.colorado.edu/sims/cheerpi/photoelectric/latest/photoelectric.html?simulation=photoelectric>

Move the wavelength slider to the red light,



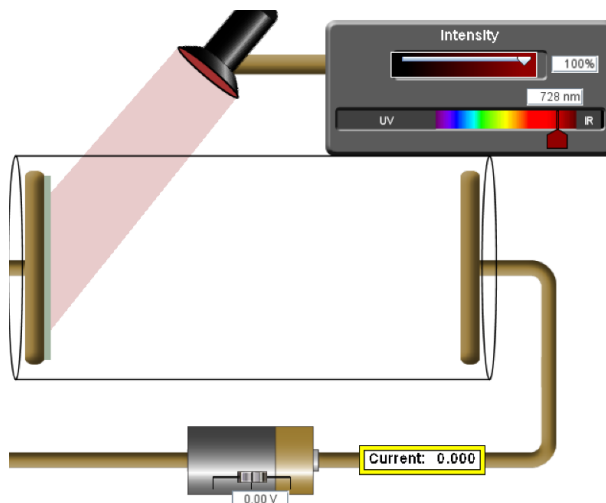
Move the Intensity slider to 100%.



Observe the metal plate that the light is shining on. If electrons are ejected, the current field will be greater than zero.

(a) Are electrons being emitted when red light shines on the metal? Why not?

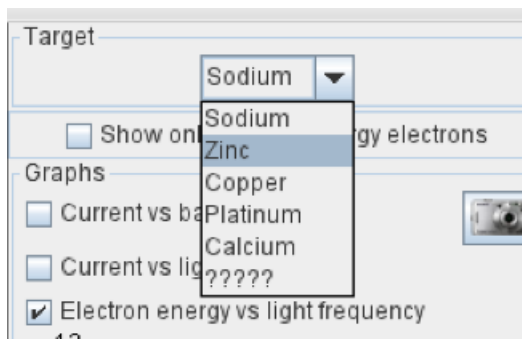
(b) Gradually move the wavelength slider to the left, until you see electrons begin to fly off the left plate. At what wavelength does this occur?



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- (c) Observe the speed of the electrons given off. Now, decrease the Intensity of the light by sliding the Intensity slider to the left, but not all the way to zero. Does the speed of the electrons change? Why or why not?

- (d) Use the drop down to change the metal from sodium to zinc. Move the wavelength slider to the left until you see electrons begin to fly off the metal. At what wavelength does this occur?



- (e) Observe the speed of the electrons flying off the metal. Now move the slider all the way to the left. How does this change the speed of the electrons? Why?
- (f) Was the energy required to eject electrons from zinc higher or lower than that of sodium? Propose a theory why?

Skill 11.03 Problem 2

How do the findings from the photoelectric effect contradict the classical view of the wave like nature of light?

What do the findings from the photoelectric effect say about how atoms absorb energy?

Chemistry

Ticket Out the Door

Set 11: Relationship between wavelength, frequency, energy, and light

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